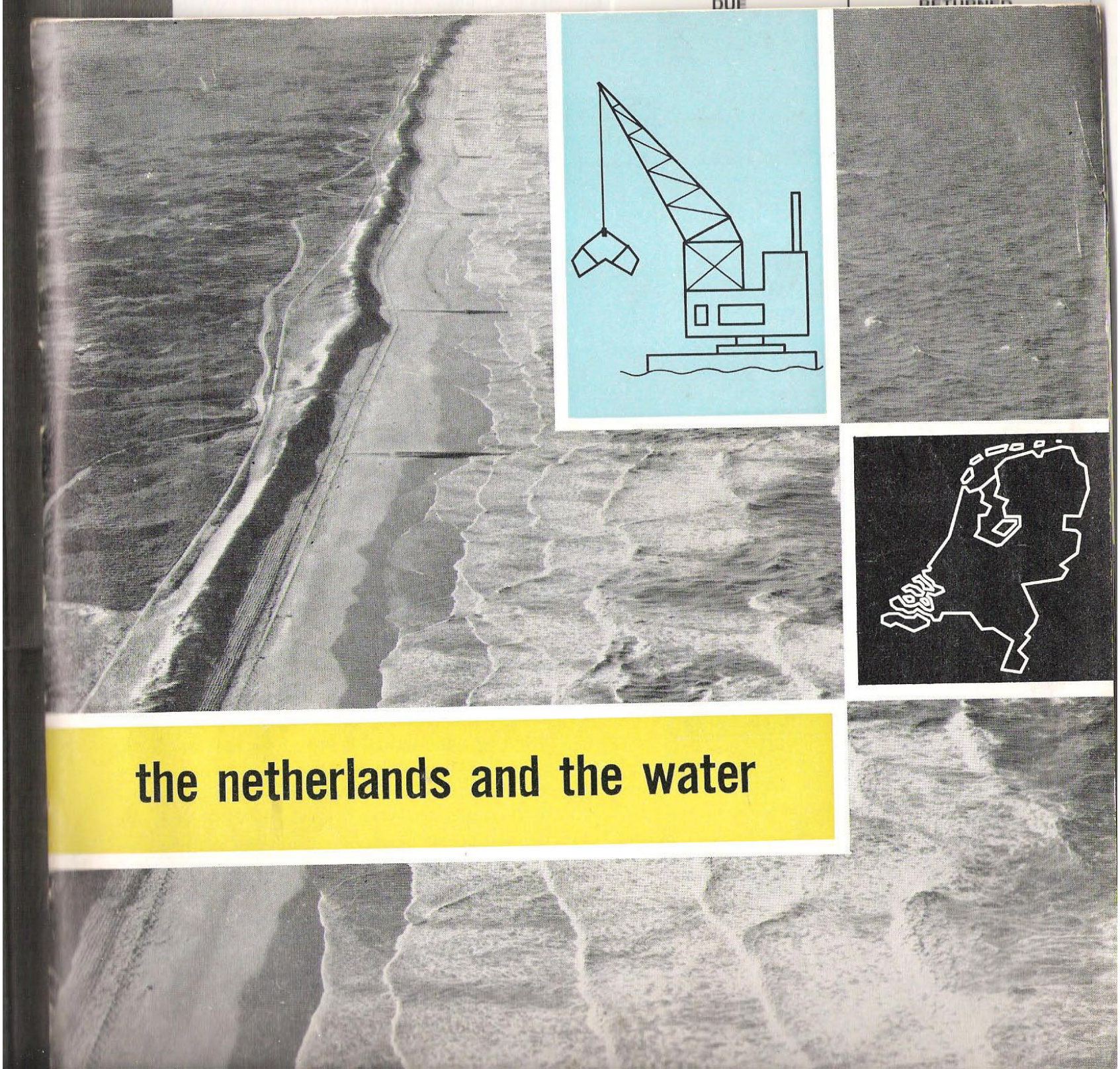
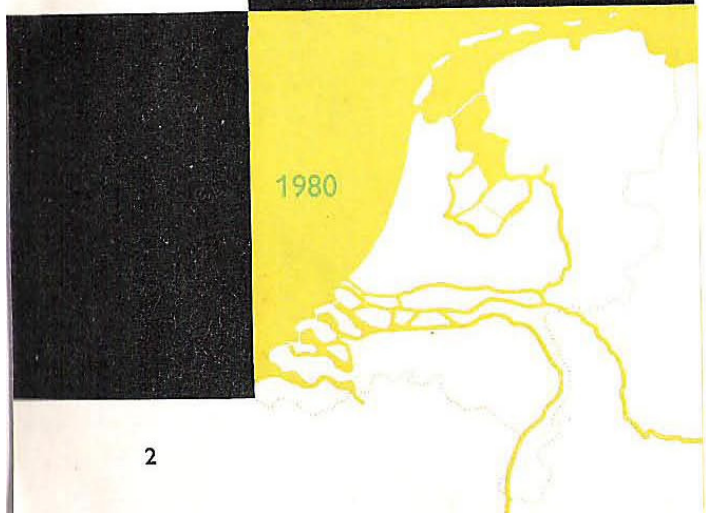
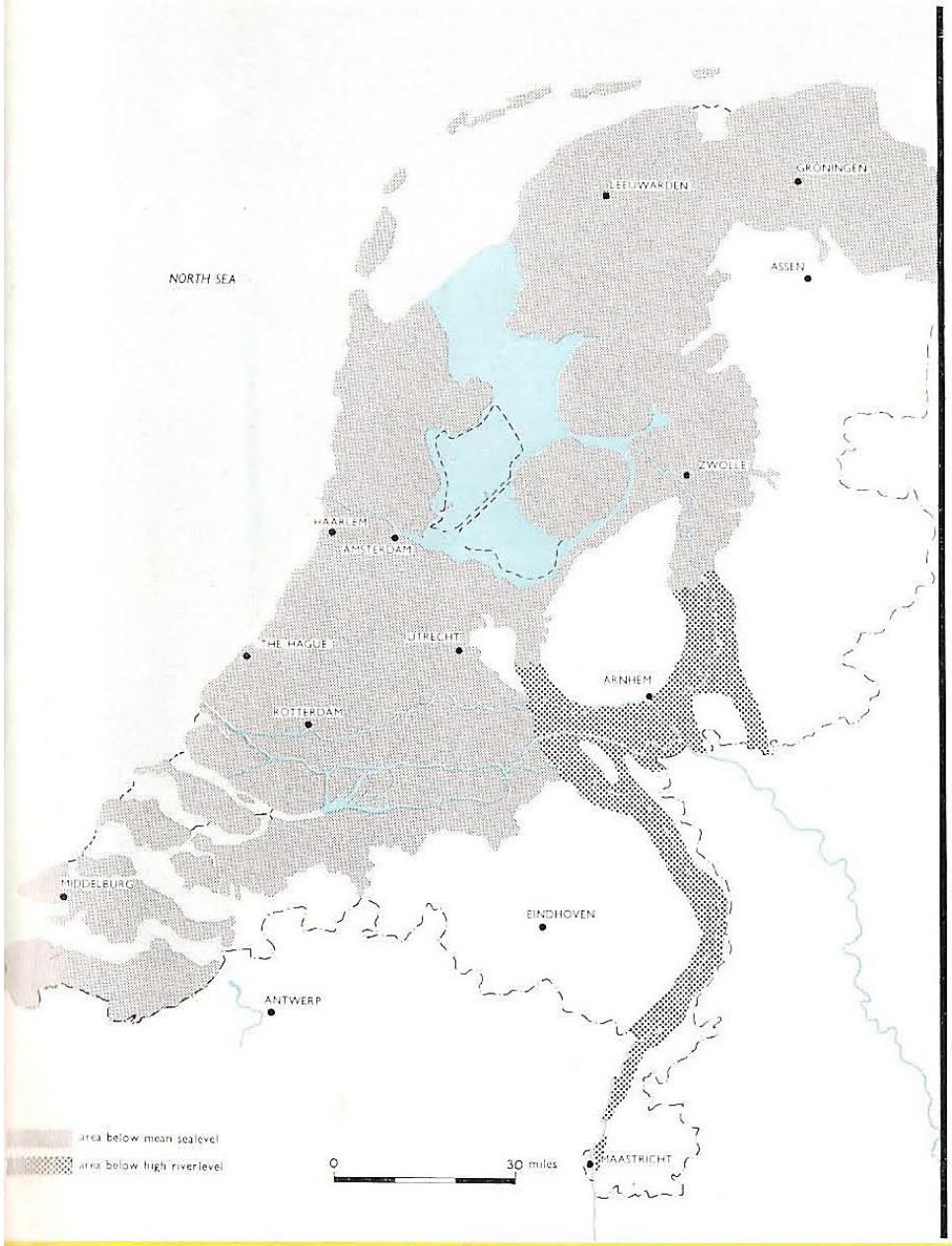


the netherlands and the water



The Netherlands and the Water

The history of no other country in the world is so closely bound up with water as is that of the Netherlands. The Netherlands was originally the watery delta of the Rivers Rhine, Maas and Scheldt. Much of the land was eroded by the water in previous eras; on the other hand, new land was formed by alluvial deposits and, in the last few centuries, by reclamation and drainage. This border region between land and water with an area of 12,525 square miles is inhabited by the people of the Netherlands (numbering about 12 million). There are about 740 people to the square mile, so the Netherlands is the most densely populated country in the world.



The Netherlands polders lying below mean sea and river levels are protected against floods by 2,000 miles of dikes and dunes. The south-west was partly flooded by the spring tide of 1st February 1953.

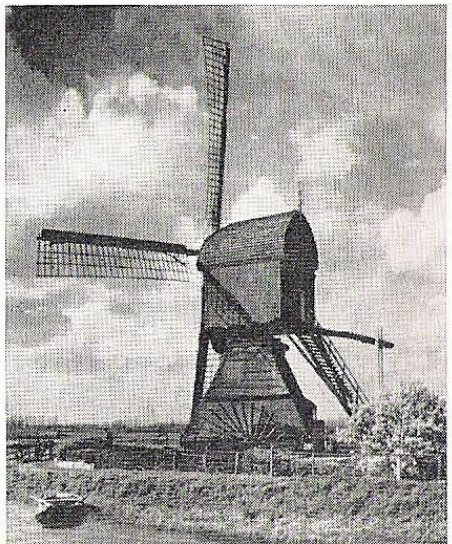
Land below sea level

More than half of the population lives on land which would be flooded at high tide if there were no sea dykes; on land, part of which was reclaimed from the water bit by bit over a period of centuries.

Here the water is constantly being kept in check and dunes and dykes are perpetually being strengthened; the struggle against the water has been going on for centuries.

The sea water that penetrates inland through the estuaries and creeks and seeps into the subsoil, the water coming down the rivers, the rainwater, it all has to be kept under control if the land is to remain inhabitable. A large number of modern pumping stations, which have largely replaced the old windmills, work day in day out – especially in winter – to get rid of the surplus water so that the inhabitants of this country behind the dykes may 'keep their feet dry'.

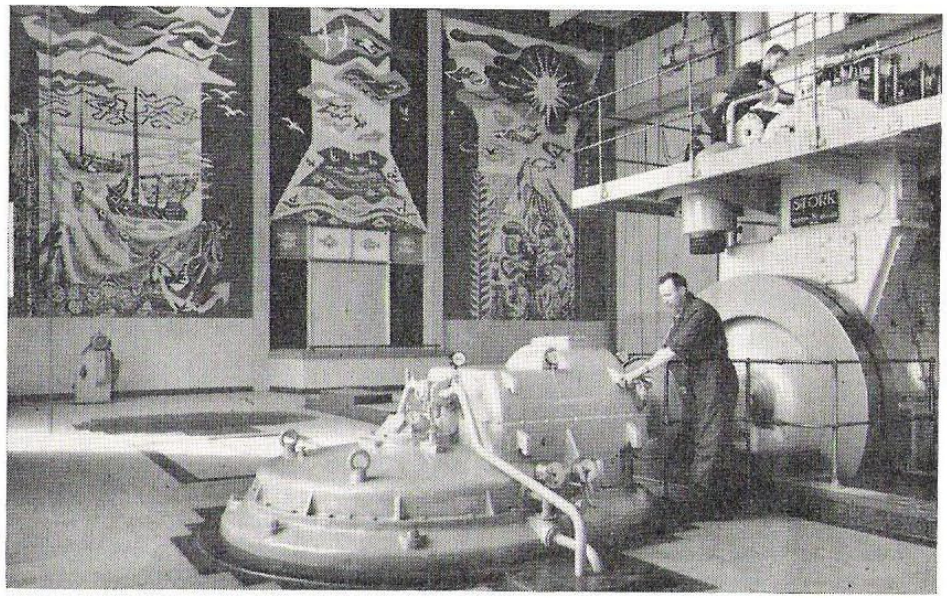
Excess water has to be removed. Formerly windmills pumped it out.



Eleven hunderd miles of dunes and dykes protect the lowlying land from the water; if it were not for these dunes and dykes half of the Netherlands would cease to exist or, at all events, be uninhabitable.

Many inner dykes form a second line of defence, so that any breaching of a sea dyke would not lead to the immediate flooding of large areas.

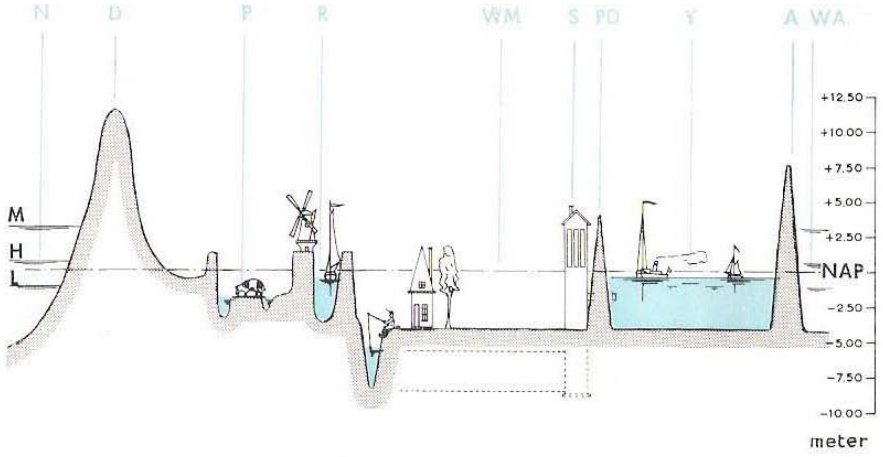
Nevertheless, the floods that have swept across the country down the ages have shown what can happen when a violent gale causes the waters of a rising tide to lash the dykes and spill over them. The last great onslaught the sea made on the land was on 1st February, 1953, when the islands in the south-west were almost completely flooded.

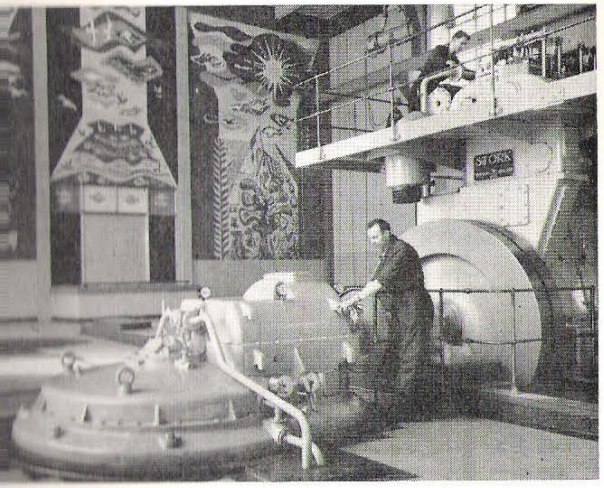


Interior of a modern pumping-station in the Zuyder Zee polders.

Cross-section showing the level of the reclaimed land below sea-level

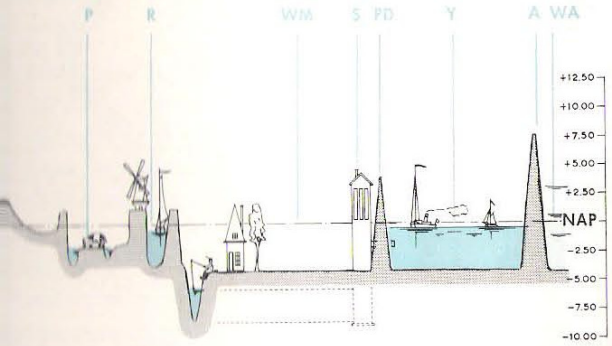
L	Low Water
H	High Water
M	Maximum Level (due to storm)
NAP	Mean Sea-Level
	Salt Water
	Fresh Water
N	North Sea
D	Dunes
P	Shallow Polder (of earlier date)
R	Belt Canal
WM	Wieringermeer Polder
S	Pumping Station
PD	Polder Dike
Y	Ysselmeer (former Zuyder Zee)
A	Barrier Dam
WA	Wadden Sea





modern pumping-station in the Zuyder Zee polders.

showing the level of the reclaimed land below sea-level



The Zuyder Zee Project

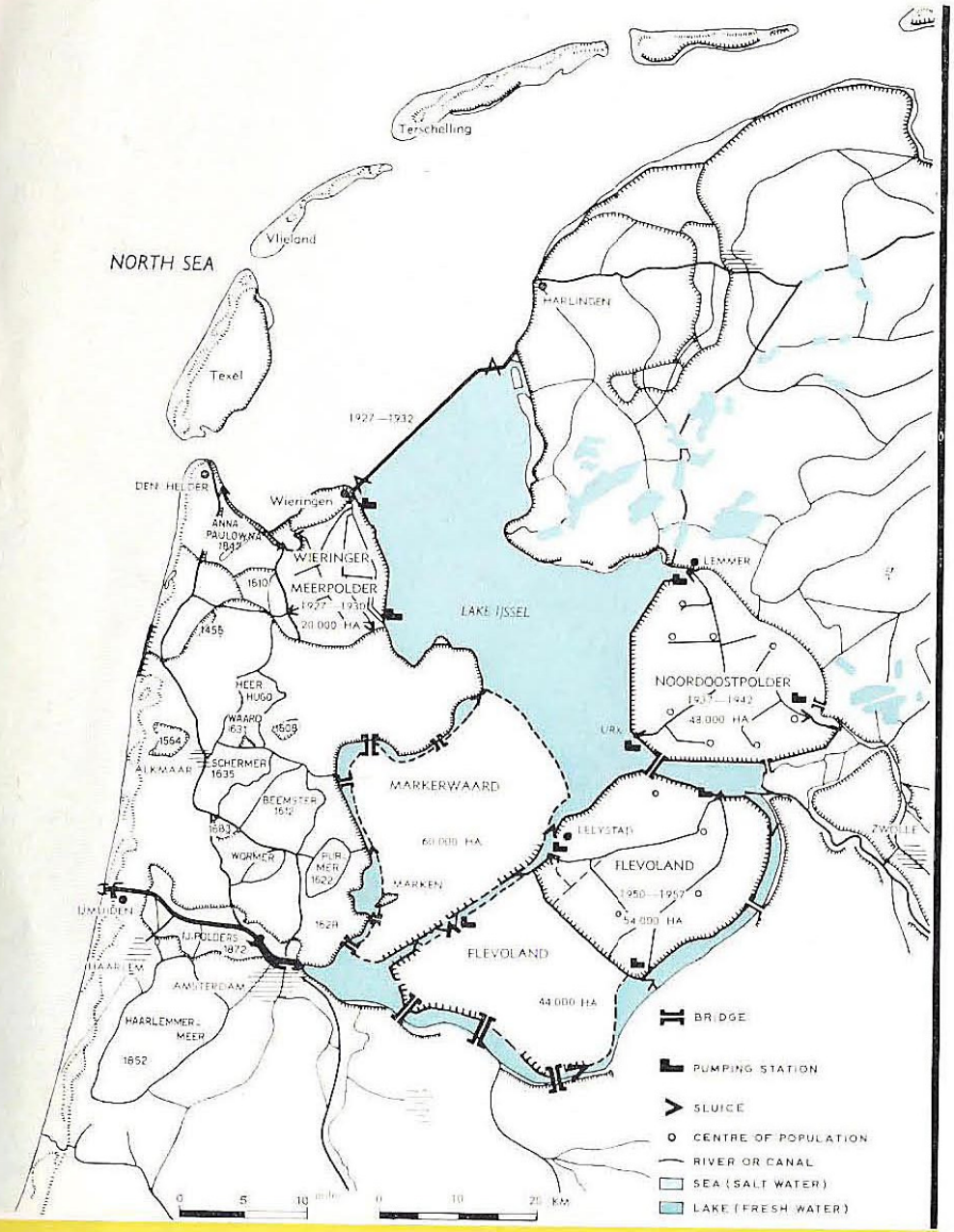
The wresting of land from the water is nothing new to the Dutch; they built dykes and made polders in their country as far back as the tenth century; that was one of the ways in which they waged war against the water. Sometimes they did so mainly to obtain new land, but there was always the concomitant advantage that it reduced the length of coastline to be defended or improved drainage conditions. Polders were created by reclaiming land from the sea or by draining lakes and marshland.

Once improved techniques had made it possible to drain even larger areas, the plan was conceived partly to drain the largest inland sea in the Netherlands — the Zuyder Zee, the bottom of which is fertile soil.

Before that could be done a dyke had to be built in the open sea between the provinces of North Holland and Friesland; it is called the 'Afsluitdijk'. (Barrier Dam.) It is twenty miles long, about 300 feet wide at sea level and about 24½ feet high, measured from N.A.P. (the normally accepted standard water level in the Netherlands).

After the dyke was completed, on 28th May 1932, the previously salt Zuyder Zee gradually changed into a freshwater inland lake. The change took place under the influence of the water flowing in from the River IJssel, a tributary of the Rhine. When the Barrier Dam was completed, the Zuyder Zee was renamed IJsselmeer.

About 1,560,000 acres of land was reclaimed from the sea.

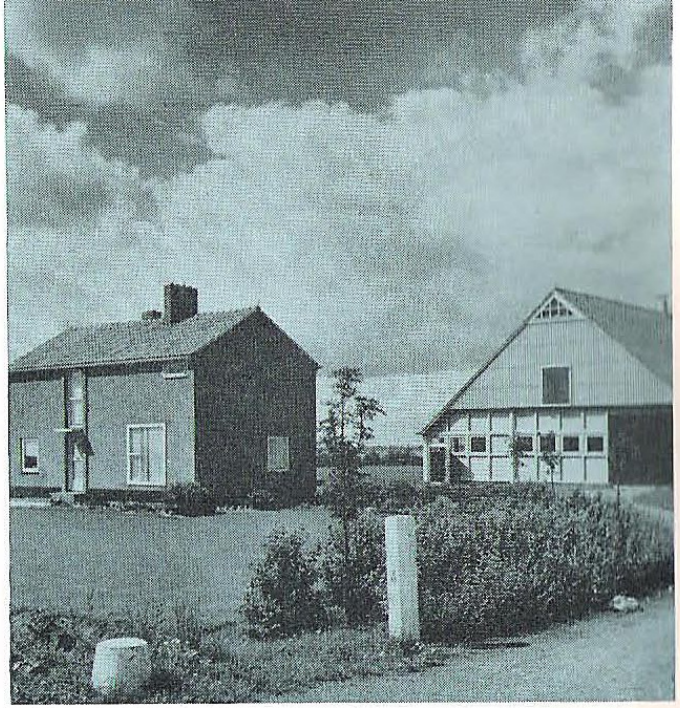


When the Zuyder Zee has been turned into polders the Netherlands will have increased its area by 10 per cent.

Damming off the Zuyder Zee shortened the coastline by nearly 200 miles. The 'Afsluitdijk' now keeps the water away from the land, whilst the old dykes in the areas bordering the former Zuyder Zee, which are no longer exposed to the tides, now form a second line of defence.

550,000 acres of what used to be the Zuyder Zee will be reclaimed; 312,000 acres will not be drained but will be used as a fresh-water reservoir. That will assure the supply of fresh water to the lower areas in the vicinity during the summer. This is essential if salination and pollution of the fresh water in the inland waterways is to be checked. The salt water that penetrates into the low-lying land from the North Sea impairs the quality of the fresh water needed for agriculture, cattle, domestic supplies and industry.

The water from the fresh water reservoir can be used to drive the salt water back partially in some areas, so that the quality of the available fresh water can be maintained. It would have paid to construct the 'Afsluitdijk' or Barrier Dam for the fresh water supply alone.
Drainage of the 50,000-acre Wieringermeerpolder which was the first Zuyder Zee polder, and work on the Barrier Dam began simultaneously. After that, the 120,000-acre Noordoostpolder was drained, followed by the 135,000–acre Oostelijk Flevoland polder. Work on the dykes for the last two polders, Markerwaard (150,000 acres) and Zuidelijk Flevoland (108,000 acres), has already commenced.
When, in about the year 1980, the reclamation work is finished the Netherlands will have added 550,000 acres, i.e. about 10%, to its arable land area.



Farm in the North-East Polder.

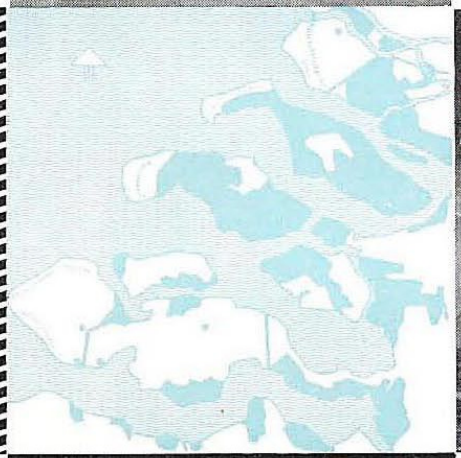
The Zuyder Zee Barrier Dam.

After the great flood of 1953 all the schemes for protecting the south-west were merged to form a single project:

The Delta Project

Once greater protection had been assured in the north by the completion of the Zuyder Zee Project and salination had been brought to a halt, attention was directed to the south-west, where broad, deep estuaries reach far inland and where many hundreds of miles of dykes are expected to protect the land from the menaces of the sea. As a result of investigations in this area, plans were drawn up for the damming off of some of the smaller estuaries, such as the Brielsche Maas between the islands of Voorne and Rozenburg and the Braakman in Zeeuws-Vlaanderen. Work was started in 1950 and 1952. In the autumn of 1952, the Minister of Transport and Waterways instructed the 'Waterstaat' engineers to draw up detailed plans for damming off some of the larger estuaries in the south-west. On 1st February, 1953, while the preliminary studies for these plans were under way the country was struck by the worst floods caused by storms in its history. As a consequence of a most unusual combination of circumstances indeed, hitherto regarded as only theoretically possible, the dykes were breached in a number of places resulting in the inundation for varying periods of over 375.000 acres of land, or about 4½% of the total area of the Netherlands, with salt or brackish water. In this disaster nearly 1800 men, women and children lost their lives, and more than 70,000 people had to be evacuated.

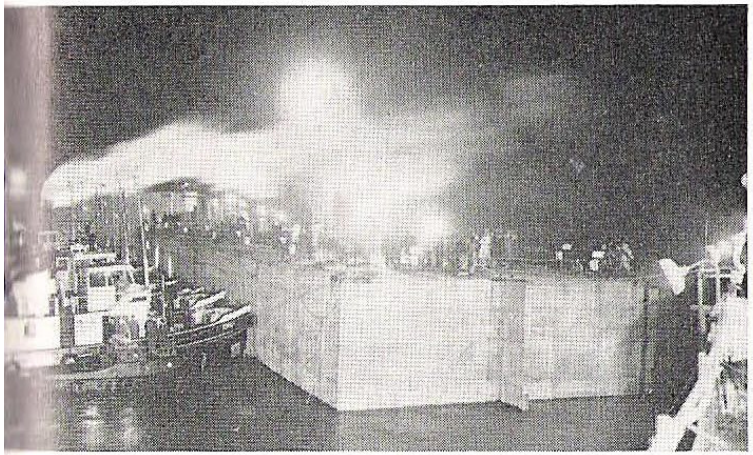
◀ The Brielsche Maas dam was completed in 1950.



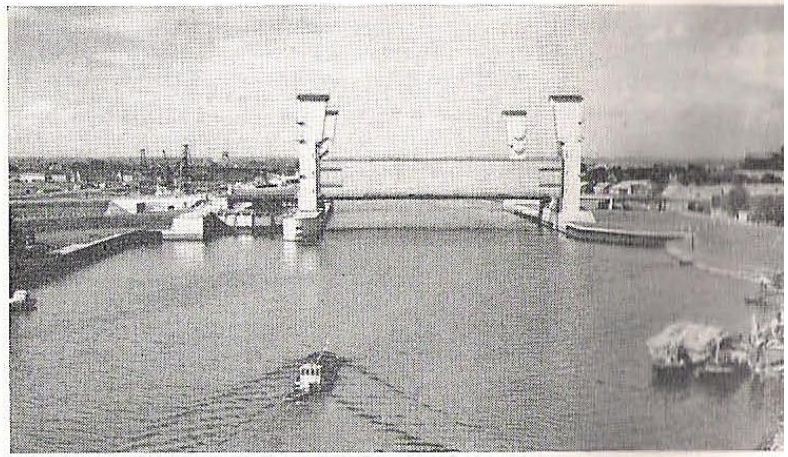
▼ Breached dike during the night of 1st February 1953.

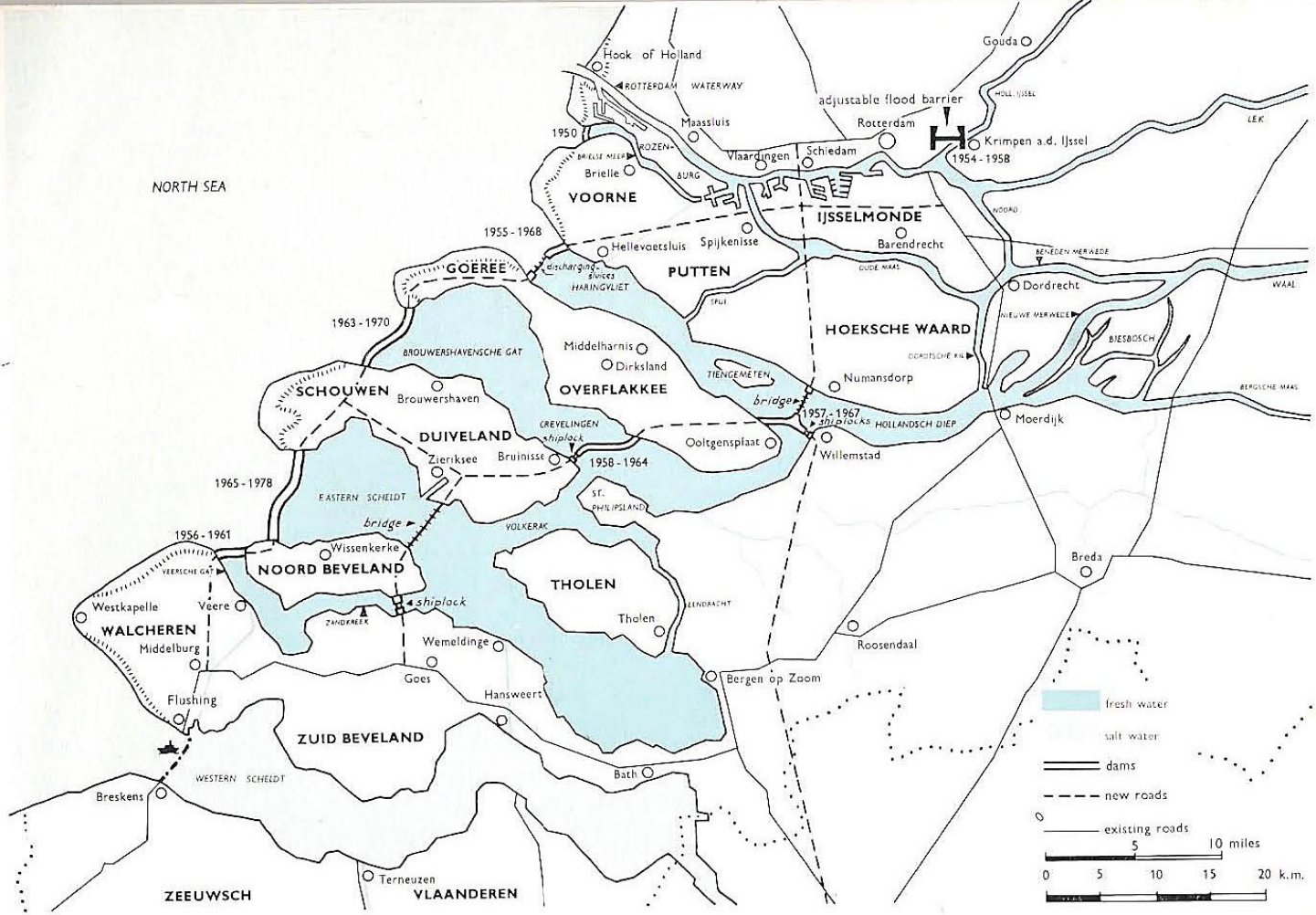
One and a half thousand million guilders' worth of damage was done.
In most cases the engineers managed to close the smaller gaps in the sea dykes and the inner dykes in the conventional way. The situation differed in respect of the large breaches through which tidal currents were flowing in and out. There was a battle at each of these breaches, a struggle against time and tide.
It was particularly difficult to close the breaches in the dykes around the old island of Schouwen-Duiveland, which lies from 5 to 6½ feet below sea level and where the average tidal amplitude – the difference in height between low and high tide – is 11½ feet, since the waters pouring in at every tide widened and deepened the gaps. Near Schelphoek, for example, the breach became 1725 feet wide and 130 feet deep, as a result of the erosive action of the water, while four deep channels were formed, through which the water washed away the soil in the polder. There were other bad breaches on this island near Ouwerkerk; they were closed with caissons.
This method was tried out for the first time on the island of Walcheren when breaches made during the war in 1945 were closed. Here huge concrete caissons 202 feet long, 59 feet wide and 62 feet high, and weighing 7000 tons were used; they were originally intended to serve as disembarkation piers for the invasion of Normandy in 1944. Our British allies still possessed a small number of these caissons in 1953, and they were now used for a peaceful purpose.
After a tough struggle, the final gap – near Ouwerkerk – was closed on 6th November, 1953, and drainage of the polders and the restoration of the heavily damaged villages and dwellings could be started.
As already stated, preliminary studies in connection with the plans for the damming off of some of the estuaries in the area which was to be so seriously hit in 1953 were actually being made in the autumn of 1952, i.e. before the flood disaster. Immediately after the disaster, the Government, set up the Delta Commission. It was given the task of investigating what water control measures would have to be taken to prevent a recurrence of such flooding.
In their report about a year later, the Commission recommended damming off the estuaries in the south-west.
The 'Delta Project', the fruits of the studies of the Delta Commission, was adopted by the Second Chamber of the States General on 5th November, 1957. It provides for the Haringvliet, the Brouwershavensche Gat, the Eastern Scheldt and the Veersche Gat and for the construction of secondary dams in the Zandkreek, the Grevelingen and the Volkerak.

Closing a breach with concrete caissons.



The first project to be completed under the Delta scheme was the adjustable flood barrier across the Hollandsche IJssel.





The Rotterdam Waterway and the Western Scheldt will not be dammed off because they give access to the ports of Rotterdam and Antwerp.

The project also made provisions for the construction of a flood barrier in the Hollandsche IJssel near Krimpen aan de IJssel to protect large areas of the Holland lowlands, where the lowest polders in the Netherlands are situated. It is like a huge sluice-gate and is only lowered in case of emergency.

The Delta Project can be compared in certain respects with the Zuyder Zee Project. When the estuaries are dammed off, a considerable reduction in the length of the coastline (440 miles) will have been achieved and consequently greater security, as was the case when the Zuyder Zee Barrier Dam was completed. Fresh water reservoirs will also be created behind the dams.

Several parts of the Delta Project have already been completed; the flood barrier in the Hollandsche IJssel was completed on 22nd October, 1958, the secondary dam in the Zandkreek became operative in October 1960 and the Veersche Gat was dammed off an 27th April, 1961. Caissons were used for the latter closure as they were in Walcheren in 1945 and in the flood disaster area in 1953, seven gigantic structures, each as large as a block of flats, 148 feet long, 77 feet wide and 59 feet high. They were not box caissons however, but sluicegate caissons.

The sluice gates built into each caisson were raised as soon as the caisson had been put into position, thus preventing any significant increase in the velocity of the current. When the last caissons had been placed in position, all the sluice-gates were lowered simultaneously at the turn of the tide, thus closing he final gap for good. The next tide found 'the doors closed' and could no longer reach the area behind the caissons, which had been turned into a lake and re-named Veersche Meer.
On 1 April 1965 the dam across the Grevelingen was completed. The work being carried out in the Haringvliet and the Volkerak is now entering its last phasis and that in the Brouwershavensche Gat is proceeding at full pressure. Work in the Eastern Scheldt will be started very shortly. Sluice gates and a lock are being constructed in the dam that will close the Haringvliet; the other dams will be devoid of sluices or locks.
The combined width of the sluices in the Haringvliet will be nearly three-quarters of a mile; the system will consist of 17 gates, each 185 feet wide.
Three weirs are being built in the Lower Rhine while the Haringvliet work is in progress. When the entire scheme has been completed, it will be possible to use the water coming down the Rhine, more than half of which now runs to waste in the sea down the Hollandsch Diep and the Haringvliet, to

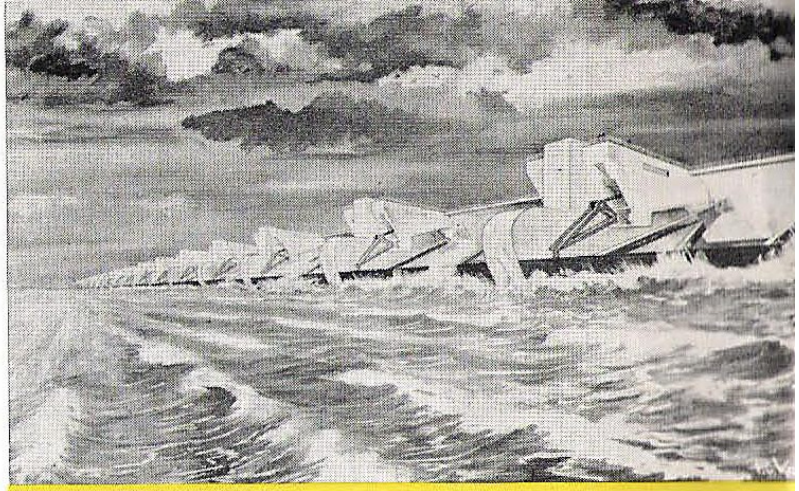
1. raise the water level in Lake IJssel, which is very necessary,

2. supply Lake Zeeland (the lake to be created inside the barrier dams) with fresh water,

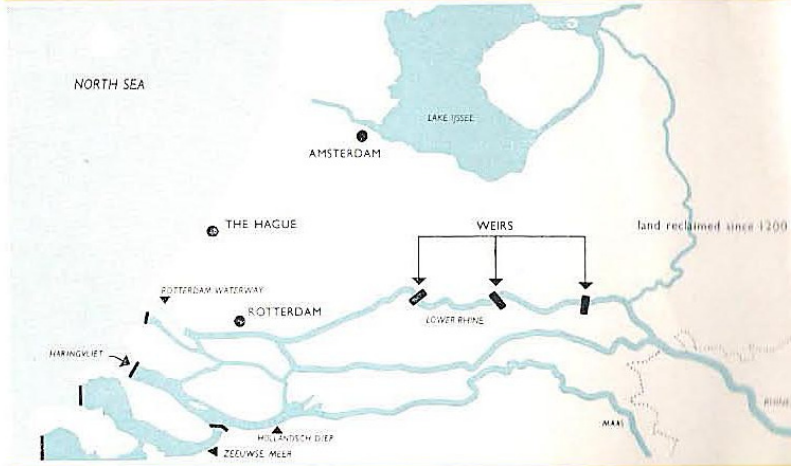
3. cause more fresh water than hitherto to flow down the Rotterdam Waterway, thus helping greatly to combat salination of the soil around Rotterdam.

When the Haringvliet sluices are closed, the entire system, including the dykes on either side, will form a sea wall. The sluices will be opened if necessary when large quantities of water and ice have to be got rid of in winter.

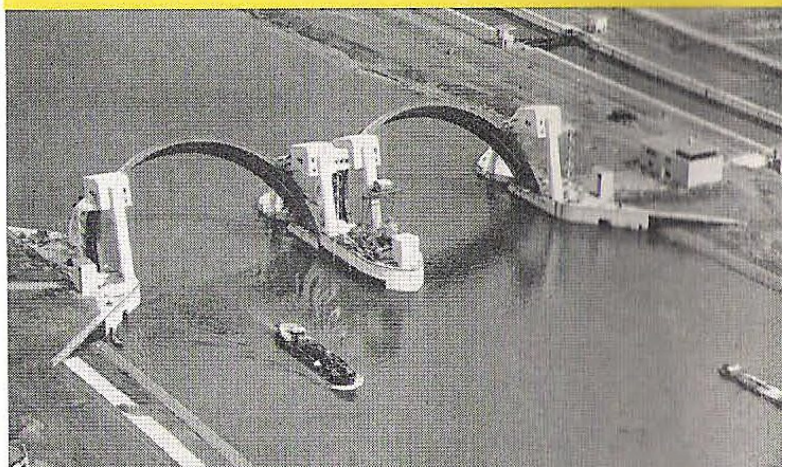
When the Delta Project is completed in 1978, greater protection against flooding and improved fresh water control will be assured and the salination of fertile soil will have been halted.

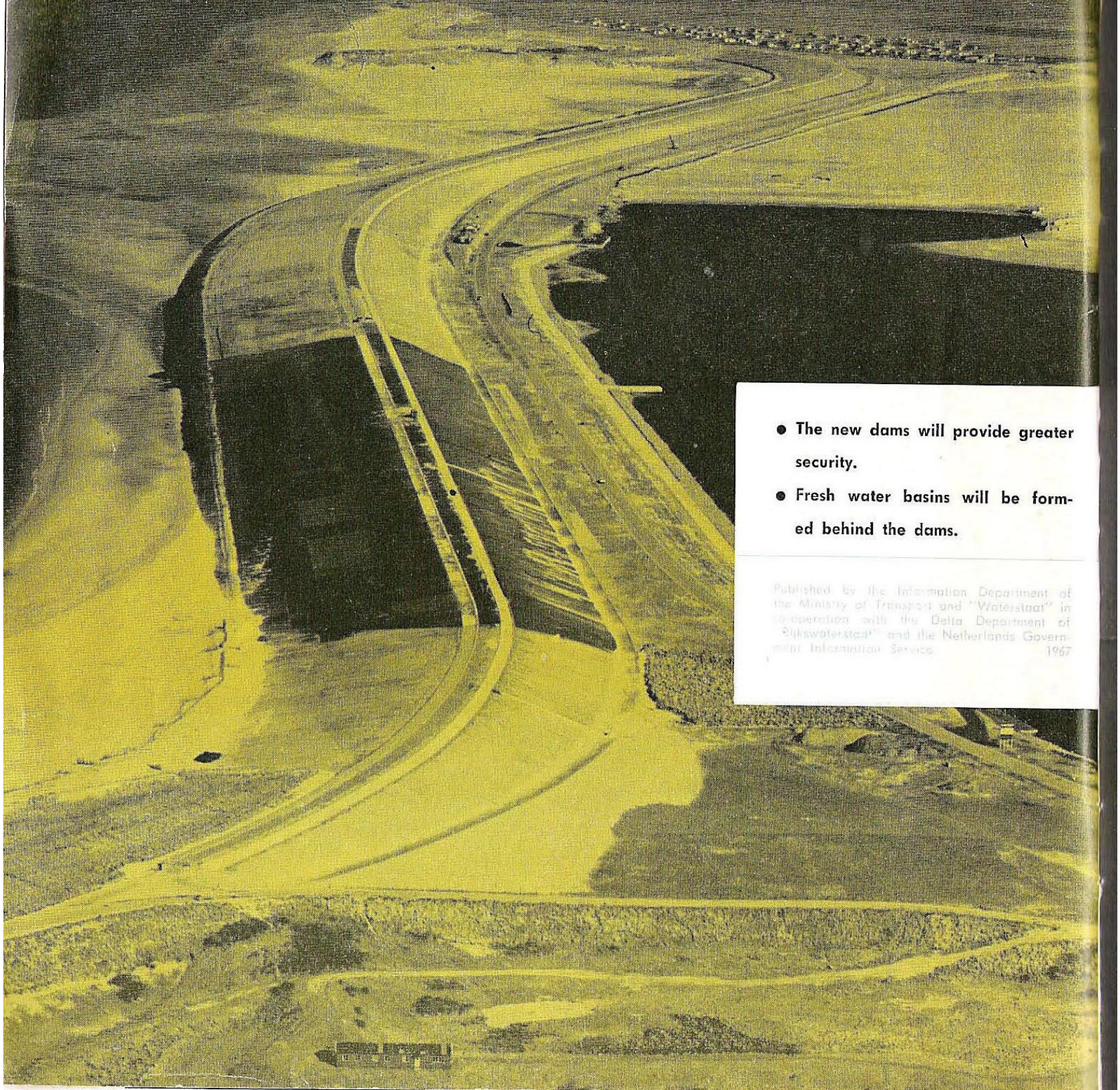


Sketch of sluices in the Haringvliet.



Canalisation of the Lower Rhine will improve distribution of fresh water.
A weir in the Lower Rhine.





- **The new dams will provide greater security.**
- **Fresh water basins will be formed behind the dams.**

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